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HEATHKIT® MANUAL

for the

TV CLOCK ACCESSORY Model GRA-601

595-1913



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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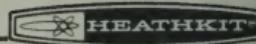


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IMPORTANT

If you are going to assemble both the TV Set and the TV Clock Accessory,
the TV Set should be assembled first.

ASSEMBLY NOTES

A separate "Illustration Booklet" contains illustrations (Pictorials, Details, etc.) that are not on pages in the Manual. When the Manual says to refer to a certain Pictorial or Detail, refer to the "Illustration Booklet" if that illustration is not on the same page or the page across from it. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.

Each circuit part in this kit has its own "Circuit Component Number" (R102, C104, IC103, etc.). This is a specific number for only that one part. The purpose of these numbers is to help you easily identify the same part in each section of this Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the Parts List;
- At the beginning of each step where a component is installed;
- In some illustrations;
- In the Schematic;
- In the sections at the rear of this Manual.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedure.

PARTS LIST

Check each part against the following list. The key numbers correspond to the numbers in the Parts Pictorial.

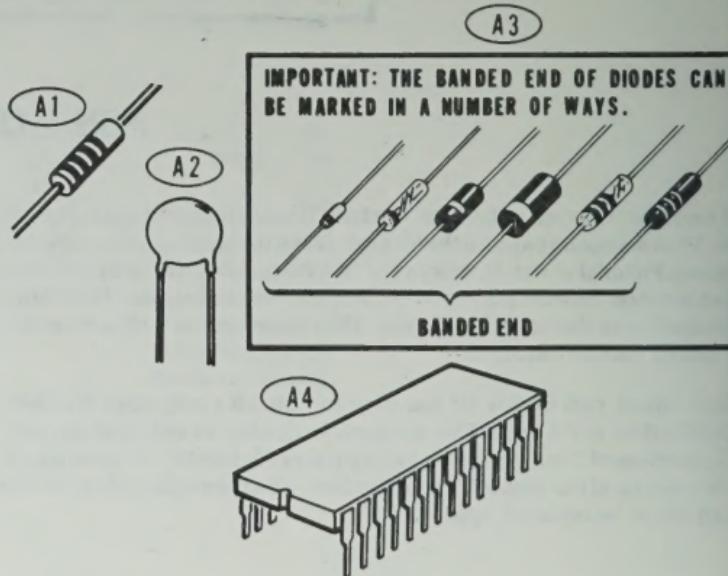
KEY	HEATH No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
		—	—	—

GENERAL

A1	1-26	1	100 kΩ, 1/2-watt resistor (brown-black-yellow)	R1
A2	21-176	3	.01 µF disc capacitor	C1, C2, C3
A3	56-56	2	1N4149 silicon diode	D1, D2
	85-1305-1	1	Printed circuit board	
	134-976	1	Cable assembly with socket	
	344-54	3"	Yellow wire	
A4	443-617	1	Clock IC (DO NOT remove it from its container until you are directed to do so).	IC1

Solder

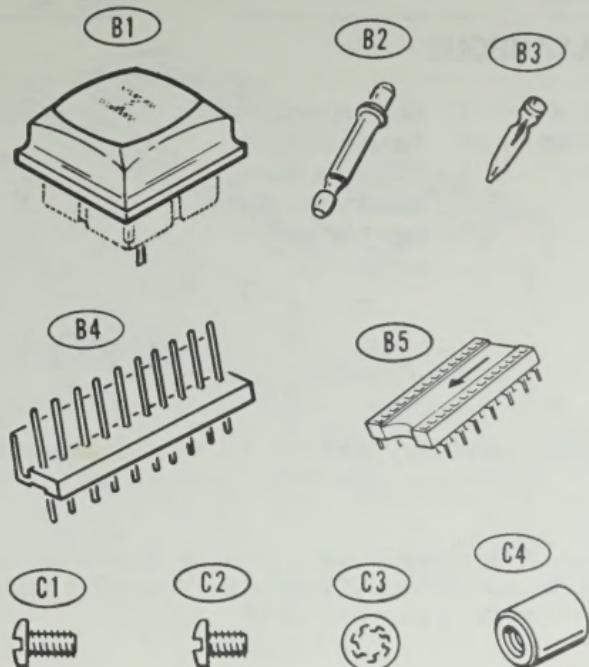
To order a replacement part, always include the Part Number. Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. For pricing information, refer to the separate "Heath Parts Price List."



KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.

SWITCHES - CONNECTORS

64-666	1	Pushbutton switches, package of 3, consisting of:	
B1	64-667	1	Pushbutton H
B1	64-668	1	Pushbutton F
B1	64-669	1	Pushbutton S
B2	432-133	1	Circuit board pin
B3	432-134	2	Connector
B4	432-877	1	10-pin plug
B5	434-270	1	28-pin IC socket



HARDWARE (shown actual size)

C1	250-56	2	6-32 × 1/4" screw
C2	250-138	2	6-32 × 3/16" screw
C3	254-1	2	#6 lockwasher
C4	255-103	2	6-32 × 5/16" spacer



KEY No.	HEATH Part No.	QTY. Part No.	DESCRIPTION	CIRCUIT Comp. No.
------------	-------------------	------------------	-------------	----------------------

MISCELLANEOUS

- | | | |
|---------|---|---|
| 391-34 | 1 | Blue and white label |
| 597-260 | 1 | Parts Order Form |
| 597-308 | 1 | Kit Builders Guide |
| | 1 | Assembly Manual (See
Page 1 for part
number.) |

STEP-BY-STEP ASSEMBLY

Before starting to assemble this kit, read the "Kit Builders Guide" for complete information on wiring, soldering, and step-by-step procedures.

The resistor is designated by the color code and the resistance value. The symbol $k\Omega$ indicates 1,000 ohms. Capacitors are designated by their value and type. The symbol μF means microfarad.

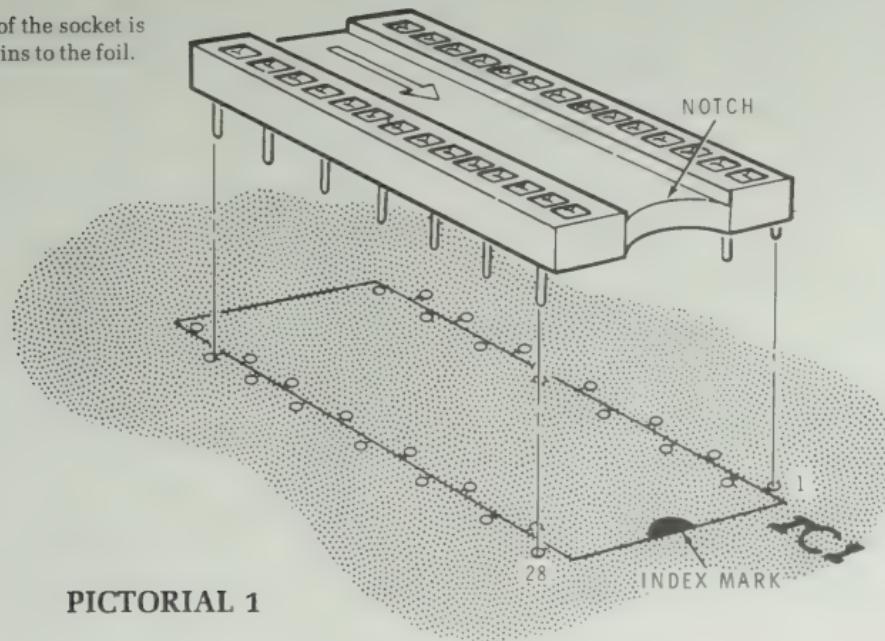
Use the utmost care to prevent solder bridges between adjacent foil areas on the circuit board. A soldering iron rated at 15 to 25 watts is adequate.

The parts will be installed on the top side of the circuit board (the side with the component outlines) and the leads will be soldered to the foil (other) side. Solder the leads **only** to the foil side of the board. Before you cut off the excess length of each lead (as shown in the "Kit Builders Guide"), look at the foil to make sure the lead has been soldered.

The clock IC is packaged with its pins inserted into a conductive foam material to eliminate any electrostatic voltage buildup between pins which might damage the IC. To avoid damage to the IC, DO NOT remove it from the conductive foam until you are directed to do so. Then save the conductive foam for use later.

Refer to Pictorial 1 for the following step.

- () Install the IC socket at IC1. Be sure the notched end of the socket is over the index mark on the circuit board. Solder the pins to the foil.

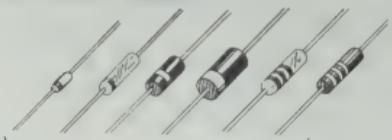


PICTORIAL 1

START

- () Position the circuit board as shown in Pictorial 2. Then perform the steps in Pictorials 2 through 4.

IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.



BANDED END

() D1: 1N4149 diode (#56-56).

() R1: 100 k Ω (brown-black-yellow).

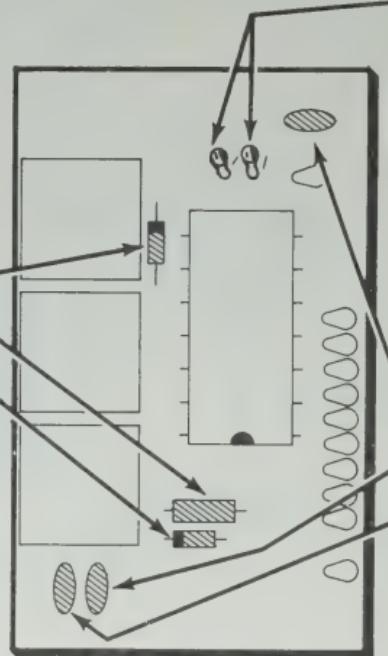
() D2: 1N4149 diode (#56-56).

() Solder all the leads to the foil and cut off the excess lead lengths.

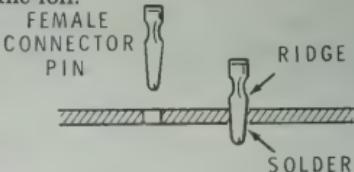
PICTORIAL 2

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

**CONTINUE**

- () Push two connectors (#432-134) into the two holes at 12 HR and 24 HR. Solder the connectors to the foil.



Before you install a disc capacitor, remove from its leads any excess body coating material which could protrude through the circuit board and cause a poor solder connection to the foil.



() C3: .01 μ F disc.

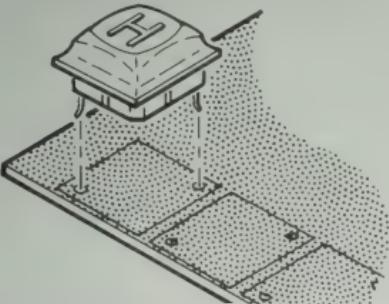
() C1: .01 μ F disc.

() C2: .01 μ F disc.

() Solder all leads to the foil and cut off the excess lead lengths.

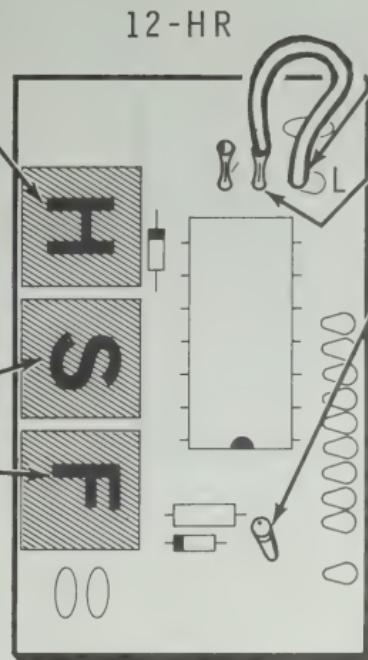
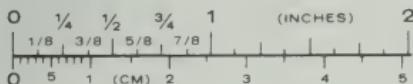
START →

- () S1: Insert the two terminals of the H pushbutton into the circuit board at S1 in the position shown. Push the button flat against the circuit board and solder the pins to the foil.



- () S2: S pushbutton at S2. Solder both pins to the foil.

- () S3: F pushbutton at S3. NOTE: If you are going to use the Clock with the GR-300, 400, or 500, rotate the F pushbutton 180 degrees before you solder the pins to the foil. (See Detail 3A.) Solder both pins to the foil.



PICTORIAL 3

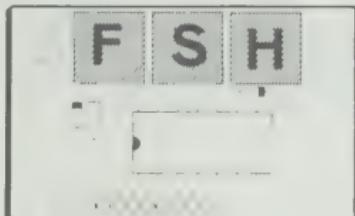
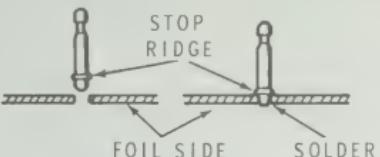
CONTINUE →

- () Remove $\frac{1}{4}$ " of insulation from each end of a 2" yellow wire.

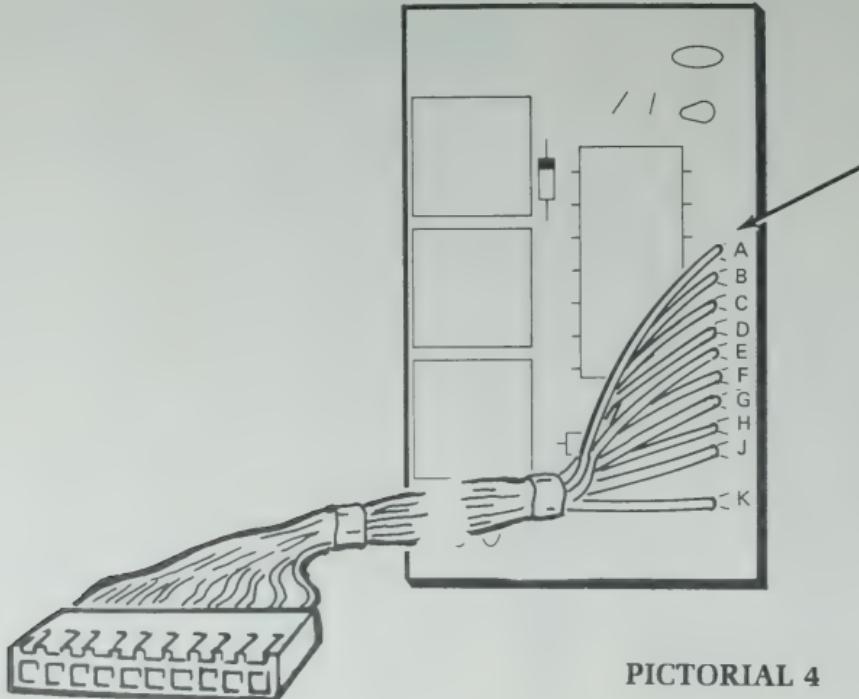
- () Insert one end of the yellow wire into hole L and solder the wire to the foil. Cut off any excess length on the foil side.

- () Push the free end of the yellow wire into the 12-HR connector.

- () Circuit board pin (#432-133) at P1. Solder the pin to the foil.



Detail 3A

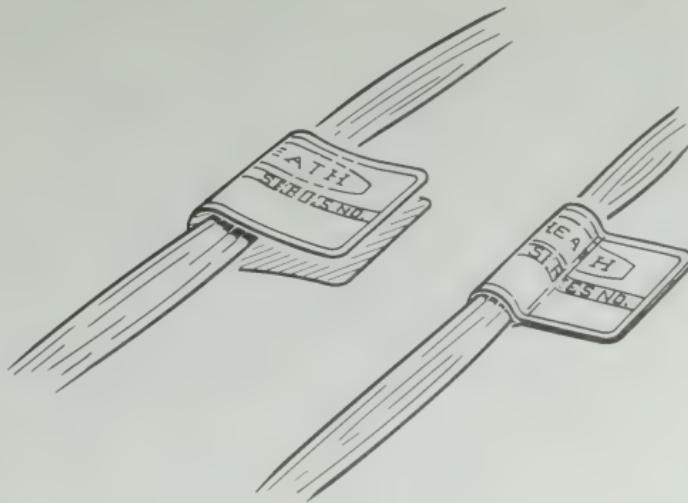
**START** ▾

Connect the 10 cable wires to the lettered holes as follows: Solder each wire to the foil and cut off any excess lead lengths.

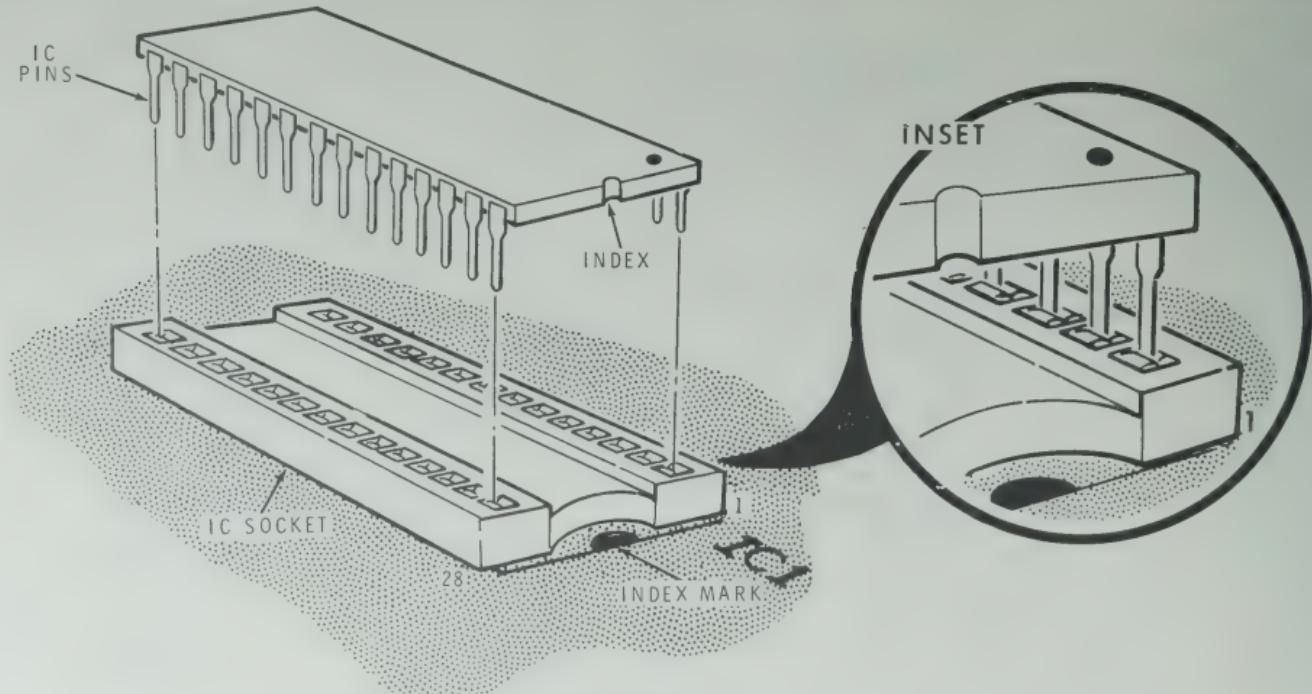
- () Gray to A.
- () Brown to B.
- () Orange to C.
- () Red to D.
- () Yellow to E.
- () Black to F.
- () Violet to G.
- () Blue to H.
- () Green to J.
- () White to K.

FINISH**PICTORIAL 4**

- () Refer to Detail 4A and install the blue and white identification label around the 10-wire cable as follows: Remove the protective backing, turn the adhesive side toward the cable, match the ends of the label around the cable, and press the ends of the label together. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.



Detail 4A



PICTORIAL 5

Refer to Pictorial 5 for the following step.

CAUTION: In the following step, before you apply downward pressure to insert the IC pins into the socket, make sure each IC pin is centered in the opening of its connector. The IC pins are very easily bent, so do not hesitate to inspect and straighten any pin which does not properly enter a connector opening. See the inset drawing on Pictorial 5.

- () Remove the clock IC from its container. Then gently pull the conductive foam from the IC pins. Position the index cutout in one end of its body over the index mark on the IC1 outline, and position the end of each IC pin in the opening of a connector. Then apply downward pressure, as evenly as possible, to push the IC pins down into the connectors of the socket. Save the conductive foam for later use.

Proceed to the installation instructions that relate to your TV Set. Installation for the GR-2001 begins on Page 14. Installation for the GR-2000 and GR-2050 begins on Page 17, and installation for the GR-300, 400, and 500 begins on Page 20.

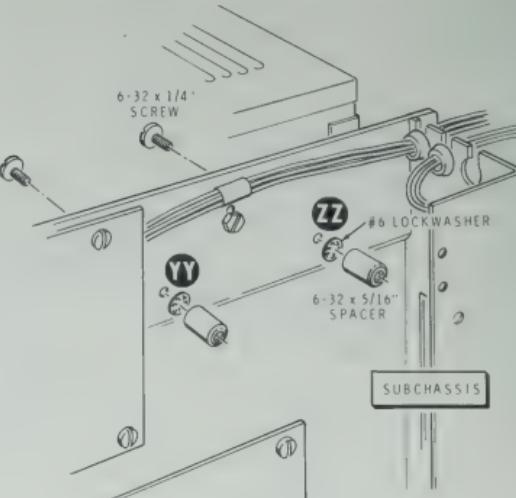
INSTALLATION (GR-2001)

NOTE: It will be easier to install the TV Clock Accessory if the TV Set is out of its cabinet.

Refer to Pictorial 6 (Illustration Booklet, Page 1) to identify the parts on the subchassis in the following steps.

- () Disconnect the line cord of the TV Set.
- () Pull the TV subchassis all the way out (forward).
- () Look at the subchassis from the right side and identify holes YY and ZZ as shown in Detail 6A. From the left side of the subchassis, insert a 6-32 × 1/4" screw in hole YY. Then place a #6 lockwasher on the screw and thread a 6-32 × 5/16" spacer onto the screw. Tighten the screw into the spacer.
- () Similarly, from the left side of the subchassis, insert a 6-32 × 1/4" screw in hole ZZ. Then place a #6 lockwasher on the screw and thread a 6-32 × 5/16" spacer onto the screw. Turn the spacer onto the screw threads with your fingers. Then, with pliers, tighten the spacer onto the screw.
- () Refer to Pictorial 6 and identify the display circuit board. Then carefully unplug cable socket S51 from the circuit board.

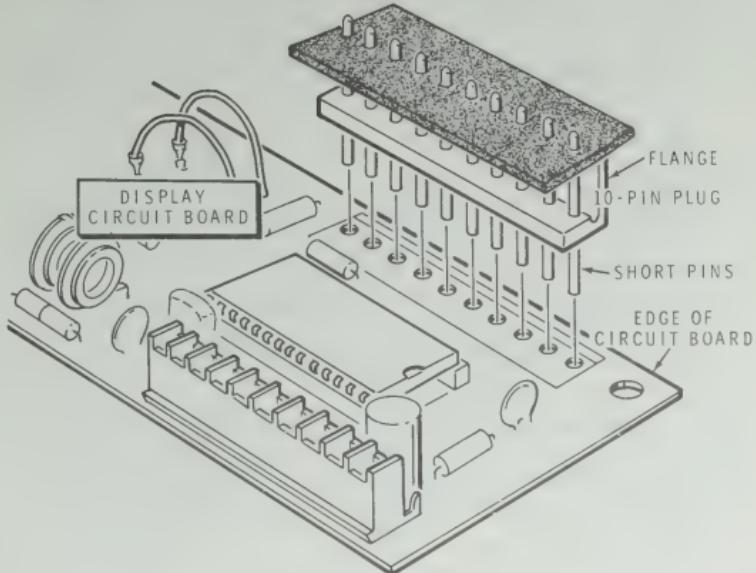
- () Remove the three 6-32 × 3/16" screws fastening the display circuit board to the spacers on the subchassis. Save the screws. Then carefully pull this circuit board out and off the pins which hold it to the tuning control circuit board underneath it.



Detail 6A

Refer to Pictorial 7 for the following steps.

- () Refer to Detail 7A (Illustration Booklet, Page 2) and push the long pins of the 10-pin plug through the conductive foam as shown. This is done so the voltage on the soldering iron tip will not damage the IC on the display circuit board.
- () Push the short pins of the 10-pin plug into the 10 holes at P-50 on the display circuit board. Make sure the flange of the plug is toward the edge of the circuit board. Solder the pins to the foil.
- () Remove the conductive foam, which may now be discarded.
- () On the display circuit board, pull the wire coming from connector C out of the CHANNEL ONLY connector and push its end into the connector at FULL DISPLAY. Refer to Pictorial 6.
- () Replace the display circuit board in its former position on the tuning control circuit board.
- () Reinstall the three 6-32 × 3/16" screws to fasten the display circuit board to the spacers on the subchassis.
- () Refer to Pictorial 6 and reinstall socket S51.



PICTORIAL 7



Refer to Pictorial 8 (Illustration Booklet, Page 2) for the following steps.

- () Mount the clock circuit board on the spacers at YY and ZZ. Use 6-32 × 3/16" screws. Be sure the pushbutton switches are positioned as shown.
- () Refer to Pictorial 8 and identify the connector on the end of the violet wire coming from socket P751. Then push this connector all the way onto pin P1 on the clock circuit board.
- () Push socket S-50, at the end of the cable coming from the clock circuit board, onto the 10-pin plug (P50) previously installed on the display circuit board. NOTE: The socket can only be installed one way.

NOTE: The "12-hour" clock system displays hours 1 through 12 twice every day. The "24-hour" clock system displays hours 1 through 24 once a day. The latter is the display system used by the military and other services to avoid confusion between AM and PM time designations.

- () Refer to Detail 8A (Illustration Booklet, Page 3) for this step. Your clock is presently set for "12-hour" operation. If you desire "24-hour" operation, pull the yellow wire from the 12 HR connector and insert it in the 24 HR connector.
- () Turn the Television Set on. After you see a picture, change the channel. Time should now be displayed on the picture tube below the channel number. NOTE: Some of the numbers may be missing at this time. If you do not see any time numbers, refer to the "In Case of Difficulty" section of this Manual.

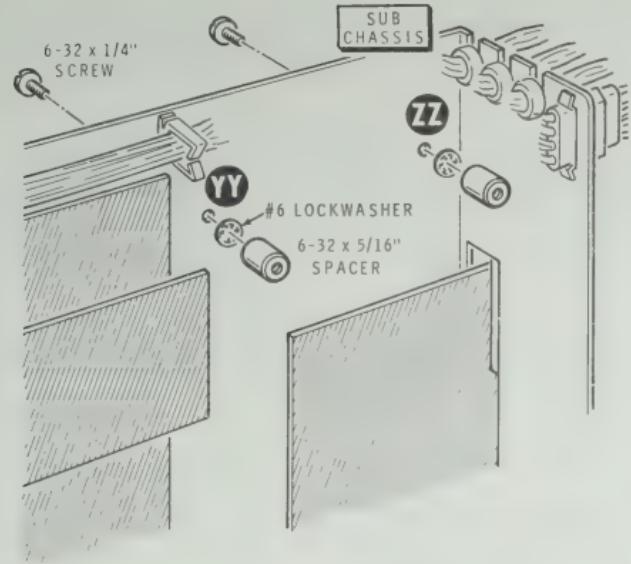
This completes the "Installation," of your TV Clock Accessory. Turn to the "Operation" section of this Manual for instructions on how to set the Clock to the correct time.

INSTALLATION (GR-2000, GR-2050)

NOTE: It will be easier to install the TV Clock Accessory if the TV Set is out of its cabinet.

Refer to Pictorial 9 (Illustration Booklet, Page 4) to identify the parts on the subchassis in the following steps.

- () Disconnect the line cord of the TV Set.
- () Pull the TV subchassis all the way out (forward).
- () Look at the subchassis from the right side and identify holes YY and ZZ as shown in Detail 9A. From the left side of the subchassis, insert a $6-32 \times 1/4"$ screw in hole YY. Then place a #6 lockwasher on the screw and thread a $6-32 \times 5/16"$ spacer onto the screw. Tighten the screw into the spacer.
- () Similarly, from the left side of the subchassis, insert a $6-32 \times 1/4"$ screw in hole ZZ. Then place a #6 lockwasher on the screw and thread a $6-32 \times 5/16"$ spacer onto the screw. Turn the spacer onto the screw threads with your fingers. Then, with pliers, tighten the spacer onto the screw.
- () Refer to Pictorial 9 and identify the readout circuit board. Then carefully pull this circuit board out and off the pins which hold it to the channel selection circuit board underneath it.



Detail 9A



Refer to Pictorial 10 (Illustration Booklet, Page 5) for the following steps.

- () Refer to Detail 7A (Illustration Booklet, Page 2) and push the long pins of the 10-pin plug through the conductive foam as shown. This is done so the voltage on the soldering iron tip will not damage the IC on the readout circuit board.
- () Push the **short** pins of the 10-pin plug into the 10 holes at P301 on the readout circuit board. Make sure the flange of the plug is towards the edge of the circuit board. Solder the pins to the foil.
- () Remove the conductive foam, which may now be discarded.
- () As shown in Pictorial 10, position the cable socket with its flat side toward the edge of the circuit board and push the cable socket onto the 10-pin plug. NOTE: The cable socket can only be installed one way.

Refer to Pictorial 9 (Illustration Booklet, Page 4) for the following steps.

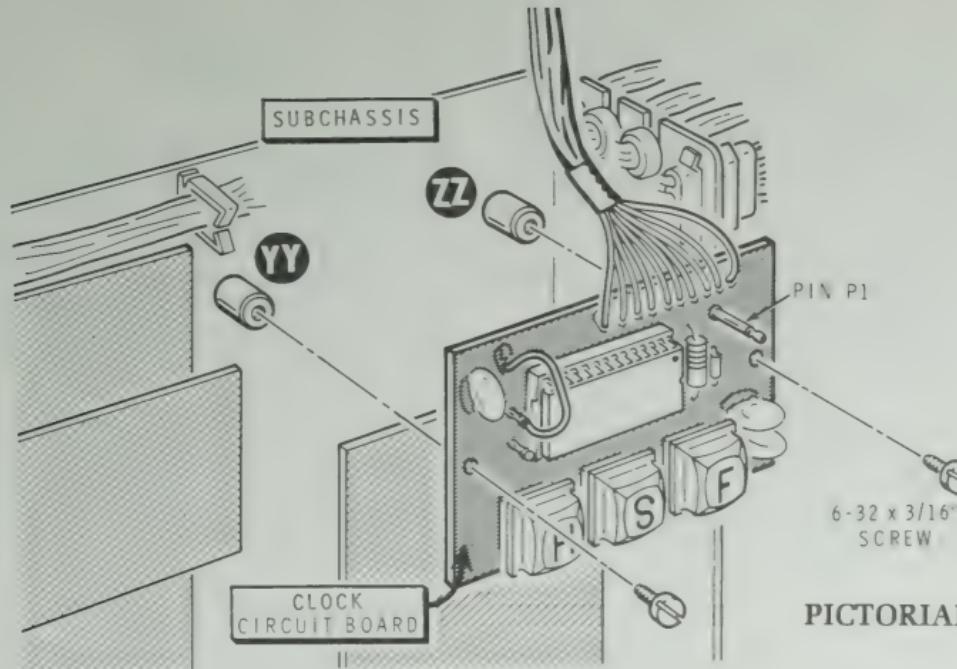
- () On the readout circuit board, pull the wire coming from hole C out of the CHANNEL ONLY connector and push its end into the connector at CHANNEL AND TIME.
- () Replace the readout circuit board in its former position on the channel selection circuit board.

Refer to Pictorial 11 for the following steps.

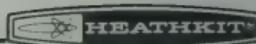
- () Mount the clock circuit board on the spacers at YY and ZZ. Use 6-32 \times 3/16" screws. Be sure the pushbutton switches are positioned as shown.
- () Refer to Pictorial 9 and identify the connector on the end of the violet wire coming from socket XX. Push the connector all the way onto pin P1 (see Pictorial 11) on the clock circuit board.

NOTE: The "12-hour" clock system displays the hours from 1 through 12 twice every day. The "24-hour" clock system displays the hours 1 through 24 once a day. The latter is the display system used by the military and other services to avoid any confusion between AM and PM when making a time designation.

- () Refer to Detail 8A (Illustration Booklet, Page 3) for this step. Your clock is presently set for "12-hour" operation. If you desire "24-hour" operation, pull the yellow wire from the 12 HR connector and insert it in the 24 HR connector.
- () Turn the Television Set on. After you see a picture, change the channel. Time should now be displayed on the picture tube below the channel number. If you do not see the time numbers, refer to the "In Case of Difficulty" section of this Manual.



This completes the "Installation" of your TV Clock Accessory. Turn to the "Operation" section of this Manual for instructions on how to set the Clock to the correct time.



INSTALLATION (GR-300, 400, 500)

Refer to Pictorial 12 (Illustration Booklet, Page 6) to identify the parts on the chassis in the following steps.

- () Remove the TV Set rear panel.
- () Loosen the two screws that secure the clock bracket and remove the bracket.

Refer to Pictorial 13 (Illustration Booklet, Page 7) for the following steps.

- () Position the clock bracket as shown.
- () From the back side of the bracket, insert a $6-32 \times 1/4"$ screw in hole 1. Then place a #6 lockwasher and a $6-32 \times 5/16"$ spacer on the screw and tighten the screw into the spacer. NOTE: Use a pair of pliers to hold the spacer.
- () Similarly, insert a $6-32 \times 1/4"$ screw in hole 2. Place a #6 lockwasher and a $6-32 \times 5/16"$ spacer on the screw. Tighten the screw into the spacer.

- () Mount the clock circuit board on the spacers, on the clock bracket, with two $6-32 \times 3/16"$ screws. Be sure the pushbuttons are positioned as shown.
- () Reinstall the clock bracket on the chassis and secure it with its mounting screws.

Refer to Pictorial 12 for the following steps.

- () Locate the violet wire with connector coming from circuit board plug K.
- () Press the connector onto pin P1 on the clock circuit board.
- () Identify the readout circuit board. Then carefully pull this circuit board out and off the pins which hold it to the chassis.

Refer to Pictorial 10 (Illustration Booklet, Page 5) for the following steps.

- () Refer to Detail 7A (Illustration Booklet, Page 2) and push the **long** pins of the 10-pin plug through the conductive foam as shown. This is done so the voltage on the soldering iron tip will not damage the IC on the readout circuit board.
- () Push the **short** pins of the 10-pin plug into the 10 holes at P301 on the readout circuit board. Make sure the flange of the plug is towards the edge of the circuit board. Solder the pins to the foil.
- () Remove and discard the conductive foam.
- () As shown in the Pictorial, position the cable socket with its flat side toward the edge of the circuit board and push the cable socket onto the 10-plug. NOTE: The cable socket can only be installed one way.
- () On the readout circuit board, pull the wire coming from hole C out (see Pictorial 12) of the CHANNEL ONLY connector and push its end into the connector at CHANNEL AND TIME.
- () Replace the readout circuit board in its former position on the chassis.

NOTE: The "12-hour" clock system displays the hours from 1 through 12 twice every day. The "24-hour" clock system displays the hours 1 through 24 once a day. The latter is the display system used by the military and other services to avoid any confusion between AM and PM when making a time designation.

- () Refer to Detail 8A (Illustration Booklet, Page 3) for the following step. Your clock is presently set for "12-hour" operation. If you desire "24-hour" operation, pull the yellow wire from the 12 HR connector and insert it in the 24 HR connector.
- () Temporarily install the rear panel with two screws.
- () Turn the TV Set on. After you see a picture, change the channel. Time should now be displayed on the picture tube below the channel number. If you do not see the time numbers, refer to the "In Case of Difficulty" section of this Manual.

This completes the "Installation" of your TV Clock Accessory. Turn to the "Operation" section of this Manual for instructions on how to set the Clock to the correct time.



OPERATION

CHANNEL AND TIME

For the GR-2001 Only

To display the time with the channel number, refer to Pictorial 6 (Illustration Booklet, Page 1) and move the jumper wire from C on the **display** circuit board into the connector at FULL DISPLAY. If you want the channel number only to be displayed, push the jumper wire from C into the CHANNEL ONLY connector.

For the GR-2000, GR-2050, GR-300, 400, 500

To display the time with the channel number, refer to Pictorial 9 (Illustration Booklet, Page 4) and move the jumper wire from C on the **readout** circuit board into the connector at CHANNEL AND TIME. If you want the channel number only to be displayed, push the jumper wire from C into the CHANNEL ONLY connector.

TIME DISPLAY DURATION

The time duration for the channel number display was selected when you built your television set. The time display will appear on your picture tube whenever the channel numbers appear and will remain for the length of time you selected for the channel number display.

CONTINUOUS DISPLAY

For the GR-2001 Only

To obtain a continuous display, refer to Pictorial 6 (Illustration Booklet, Page 1) and push the jumper wire from B on the **display** circuit board into the CONSTANT DISPLAY connector.

For the GR-2000, GR-2050, GR-300, 400, 500

To obtain a continuous display, refer to Pictorial 9 (Illustration Booklet, Page 4) and push the jumper wire from A on the **readout** circuit board into the DISPLAY connector.

SECONDS DISPLAY

For the GR-2001 Only

If you want the time display to consist of hours and minutes only, refer to Pictorial 6 and push the jumper wire from D on the **display** circuit board into the connector at "4 DIGIT." If you want seconds to be displayed with the hours and minutes, push the jumper wire from D into the connector at "6 DIGIT."

NOTE: Should the channel number disappear when readjusting from a 4-digit to a 6-digit time display, reposition the display by adjusting the HORIZ POS control on the **display** circuit board.



For the GR-2000, GR-2050, GR-300, 400, 500

If you want the time display to consist of hours and minutes only, refer to Pictorial 9 (Illustration Booklet, Page 4) and push the jumper wire from B on the **readout** circuit board into the connector at "4 DIGIT." If you want seconds to be displayed with the hours and minutes, push the jumper wire from B into the connector at "6 DIGIT."

NOTE: Should the channel number disappear when readjusting from a 4-digit to a 6-digit time display, reposition the display by adjusting the HORIZ POS control on the **readout** circuit board.

12-HOUR OR 24-HOUR TIME DISPLAY

"12-hour time" displays the hours 1 through 12 twice each day, as do most clocks. "24-hour time" displays the hours 1 through 24 once each day. The latter system is becoming increasingly popular as it eliminates any confusion between "AM" and "PM". Either system is selected by inserting the jumper wire from L on the **clock** circuit board into the 12 HR or the 24 HR connector. See Pictorial 14 (Illustration Booklet, Page 7).

PUSHBUTTON FUNCTIONS

Refer to Pictorial 14 (Illustration Booklet, Page 7). The following functions occur only while the pushbutton is depressed:

H (hold): Stops the display and the Clock to permit the actual time to catch up to the display. This is normally used when only a short time is involved.

S (slow): Advances the minutes display at the rate of one minute per second (seconds display is also speeded up).

F (fast): Advances the hours display at the rate of one hour per second (the minutes display is also speeded up).

INCORRECT TIME DISPLAY

Upon initial turn-on of your TV Set after the clock has been installed, or any time there has been a power interruption (a power failure or turn-off of the TV master switch), a random display of the hours can occur. There may be no display of the hours at all, or hours in excess of 12 or 24 (as applicable) may be displayed. In either case, reset the clock according to the instructions in the following section.



SETTING THE CLOCK

Refer to Pictorial 14 (Illustration Booklet, Page 7).

NOTE: When the TV master switch is ON, the Clock will continue to keep time as long as the television set line cord is connected to the wall outlet. Should the line cord become disconnected, or a power failure occur, it will be necessary to reset the Clock.

1. Obtain a continuous display, as described previously under "Continuous Display."
2. Adjust the hours display by depressing the F pushbutton on the clock accessory circuit board until the desired hours display is seen. Then depress the S pushbutton until the minutes display is correct. NOTE: On the GR-300, 400, and 500, insert an insulated tool through a vent hole in the rear panel to depress any of the clock pushbuttons.

3. If you want your clock exactly synchronized with a TV or radio station "time beep," the procedure consists of setting the Clock (in advance) to the time you expect to hear the time beep, and then stopping the Clock with the H (hold) button until you hear the beep. At this instant you release the H button. Of course, you must start soon enough so you will have time to perform the steps below.

NOTE: The following example will assume you want to synchronize your Clock at 12:00 hours (noon) with a 6-digit display. Start the procedure about half a minute in advance.

- () Depress the F button until the hours read "11."
- () Depress the S button until the minutes read "59."
- () Let the Clock run until the seconds read "00." Then quickly push and hold the H button. The clock will now read "12:00:00."
- () When you hear the time beep, release the H button.

IN CASE OF DIFFICULTY

Try to analyze the symptoms of any problem you might have before starting any troubleshooting procedure. This can usually be accomplished by trying the various functions of your Clock Accessory to determine abnormal operation. A review of the "Operation" section may help your analysis. The "Troubleshooting Chart" lists a number of possible difficulties that could arise along with several possible solutions to those difficulties.

NOTE: Refer to the "Circuit Board X-Ray View" on Page 29 for the physical location of parts on the circuit boards.

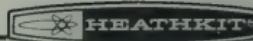
GENERAL TROUBLESHOOTING INFORMATION

1. Check all the wires that are connected to the circuit board and between the circuit board and other parts. Make sure these wires are connected to the proper points and are properly soldered. Someone who is not familiar with the unit may notice something you have consistently overlooked.
2. About 90% of the kits that are returned for repair do not function properly because of poor connections and soldering. Therefore, many troubles can be located by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Reheat any doubtful connections. CAUTION: DO NOT reheat any IC connectors unless the IC is removed.

3. Closely examine the circuit board foil in a good light to see that no solder bridges exist between adjacent connections. If available, a magnifying glass would be helpful for this purpose. Remove any solder bridges by holding a clean, hot soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip. Compare your foil pattern against the "Circuit Board X-Ray View" on Page 29.
4. Check the integrated circuit for proper positioning. Be sure the dot or notched end of the IC is over the index mark printed on the circuit board. Be sure each IC pin has properly entered its socket.
5. Be sure the banded end of each diode is positioned correctly.
6. Check all component leads connected to the circuit boards. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts.

If you still cannot locate and correct the trouble after the above tests are completed, and if a voltmeter is available, check the voltages against the values shown on the Schematic Diagram (fold-in).

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.



Troubleshooting Chart (GR-2001)

NOTE: Before doing any troubleshooting, carefully inspect the IC to make sure each pin is properly seated in its socket.

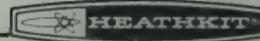
DIFFICULTY	POSSIBLE CAUSE
Time is displayed but does not advance.	1. Connection to P1. 2. C1, R1, D1, D2, IC1.
Time is not displayed when Full Display is selected. Channel is displayed.	1. Check foil and connection from C to IC50 on display circuit board. 2. IC1. 3. IC50 on display circuit board.
Time advances too fast.	1. F or S pushbuttons shorted. 2. IC1.
Time display does not advance chronologically.	1. Wiring harness connections to clock circuit board.
12-HR/24-HR select feature operates improperly.	1. Refer to "Operation" section for "Setting the Clock." 2. IC1. 3. Connections from L to IC1.

Troubleshooting Chart

(GR-2000, GR-2050, GR-300, 400, 500)

NOTE: Before doing any troubleshooting, carefully inspect the IC to make sure each pin is properly seated in its socket.

DIFFICULTY	POSSIBLE CAUSE
Time is displayed but does not not advance.	1. Connection to P1. 2. C1, R1, D1, D2, IC1.
Time is not displayed when Channel and Time is selected. Channel is displayed.	1. Check foil and connection from C to IC301 on readout circuit board. 2. IC1. 3. IC301 on readout circuit board.
Time advances too fast.	1. F or S pushbuttons shorted. 2. IC1.
Time display does not advance chronologically.	1. Wiring harness connections to clock circuit board.
12-HR/24-HR select feature operates improperly.	1. Refer to "Operation" section for "Setting the Clock." 2. IC1. 3. Connections from L to IC1.

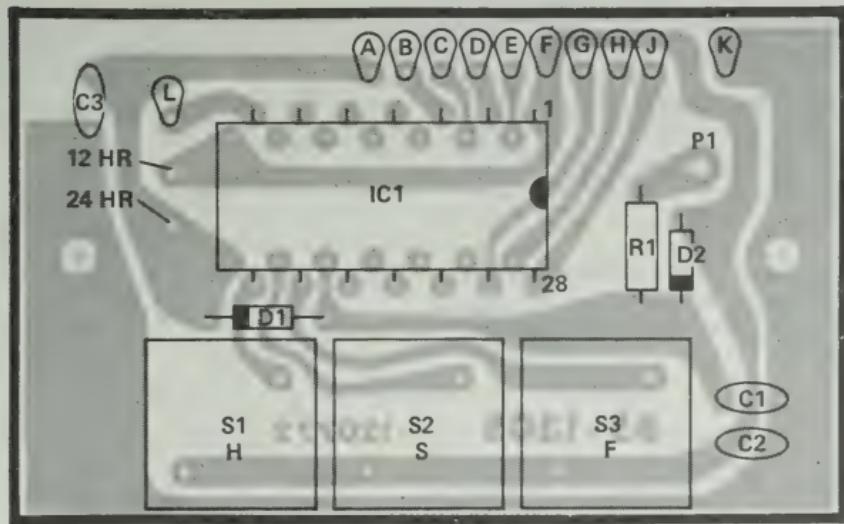


SPECIFICATIONS

Integrated Circuit	Monolithic MOS integrated circuit using P-channel enhancement mode, low-threshold technology.
Time Base	60 Hz power line frequency.
Display	Optional: 1. Hours and minutes or Hours, minutes, and seconds. 2. 12-hour or 24-hour time display.
Time Setting	By means of F (fast), S (slow), and H (hold) pushbuttons.
Logic Power Source	Color Television Set (+5.1 volts for logic 1 and -8.2 volts for logic 0).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT BOARD X-RAY VIEW



(Viewed from component side)

CIRCUIT COMMENTS

While you read the following paragraphs, look at the connection diagram, Pictorial 15, and the Schematic Diagram.

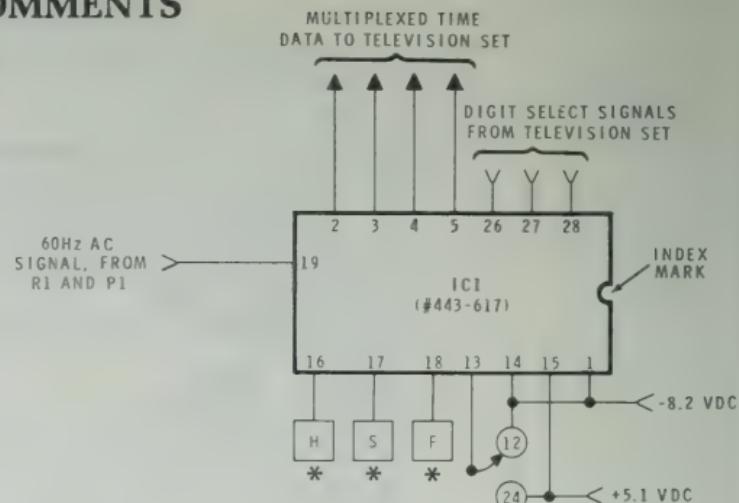
IC1 is a monolithic, MOS integrated circuit. It contains all the logic circuitry required to provide 6-digit, 12- or 24-hour time data to the circuitry in your Color Television Set.

The clock circuit operates from a 25 volt AC, 60 Hz input signal connected to the time display circuit board at pin P1, from there it is coupled by resistor R1 to pin 19 of IC1. Diode D1 clamps the positive half cycles to +5.1 VDC and diode D2 clamps the negative half cycles to -8.2 VDC. C1, C2, and C3 are bypass capacitors.

Three momentary pushbutton switches set the time. Pushbutton H (S1) stops the clock to allow actual time to catch up with the display, pushbutton S (S2) advances the minutes display at a rate of one minute per second, and pushbutton F (S3) advances the hours display at a rate of one hour per second.

Either a 12-hour or a 24-hour time cycle can be displayed. This is accomplished by connecting pin 13 to pin 14 for a 12-hour display, or pin 13 to pin 15 for a 24-hour display. Voltages of +5.1 VDC and -8.2 VDC are supplied from the Color Television Set.

The time display can include hours, minutes, and seconds; or can be composed of hours and minutes only. This selection is explained on Page 22.



*

H = HOLD. ALLOWS TIME TO CATCH UP TO THE DISPLAY.

S = SLOW. ADVANCES MINUTES DISPLAY AT 1 MINUTE PER SECOND.

F = FAST. ADVANCES HOURS DISPLAY AT 1 HOUR PER SECOND.

PICTORIAL 15

Digit select voltages are supplied on wires G, H, and J from the Color Television Set, and multiplexed time data is fed back to the Color Television Set on lines B, C, D, and E.

Mike will ship

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

SEND TO:

HEATH COMPANY
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT
Phone (Replacement parts only):
616 982-3571

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, \$3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

- If you prefer COD shipment, check the COD box and mail this card.

Total enclosed \$ _____ COD

NAME _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____

Invoice # _____

Location Purchased _____

Date Purchased _____

**LIST HEATH
PART NUMBER**

QTY. _____

PRICE
EACH

TOTAL
PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

TOTAL AMOUNT OF ORDER

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

Replacement parts are maintained specifically to repair Heath products. Parts sales for other reasons will be declined.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance, you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of resilient packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

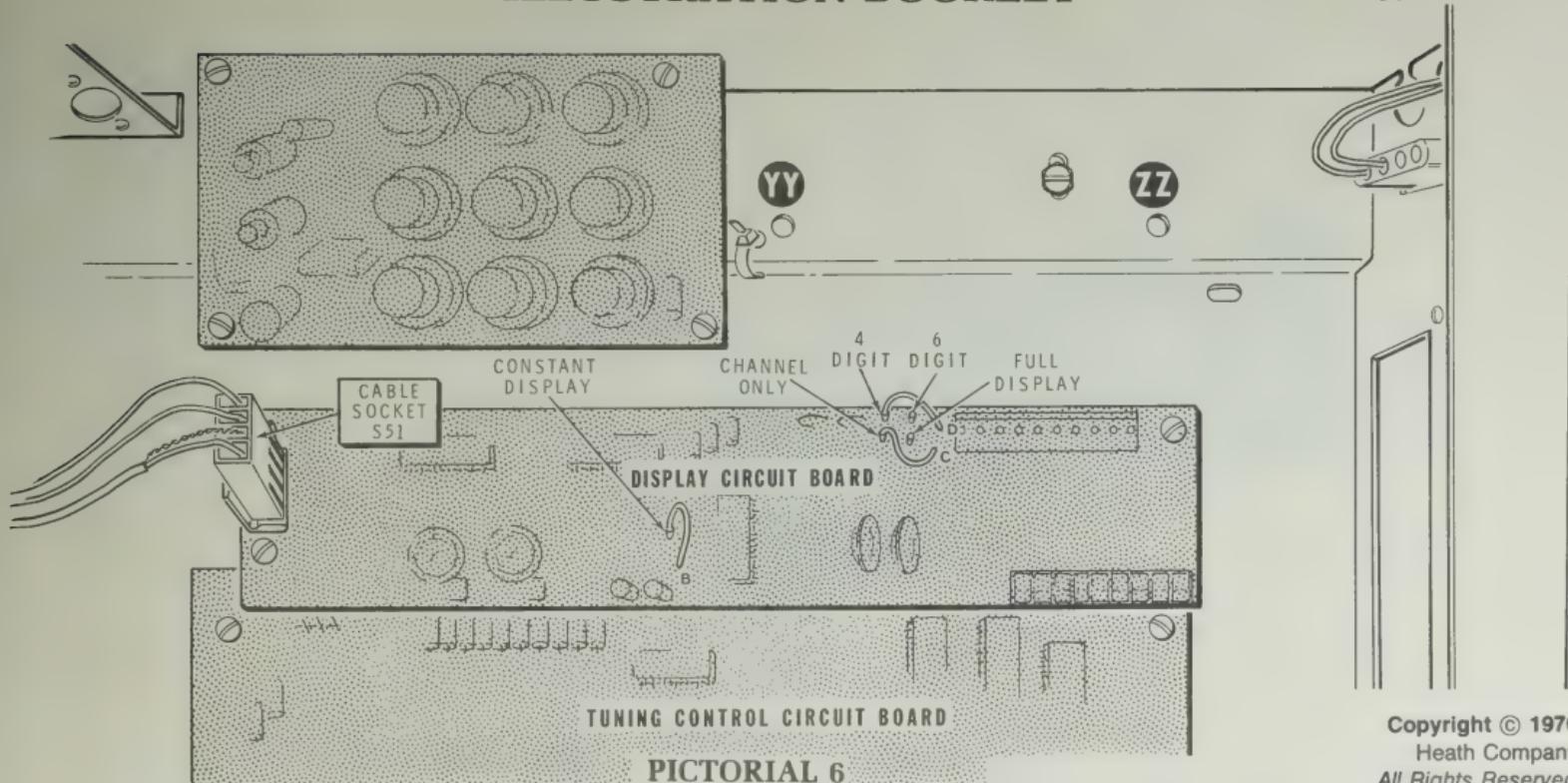
HEATH

Schlumberger

HEATH COMPANY • BENTON HARBOR, MICHIGAN
THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

ILLUSTRATION BOOKLET

Part of 595-1913



PICTORIAL 6

Model GRA-601

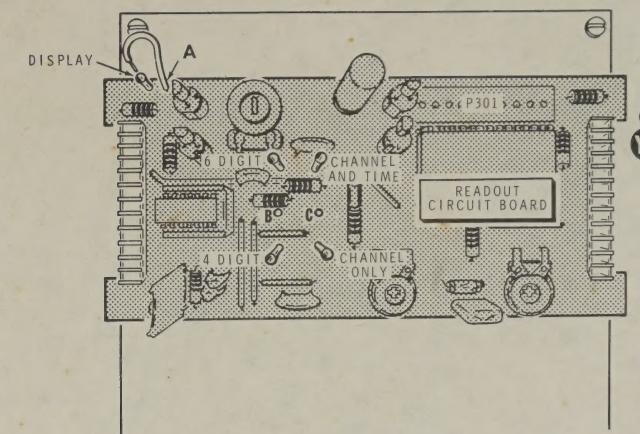
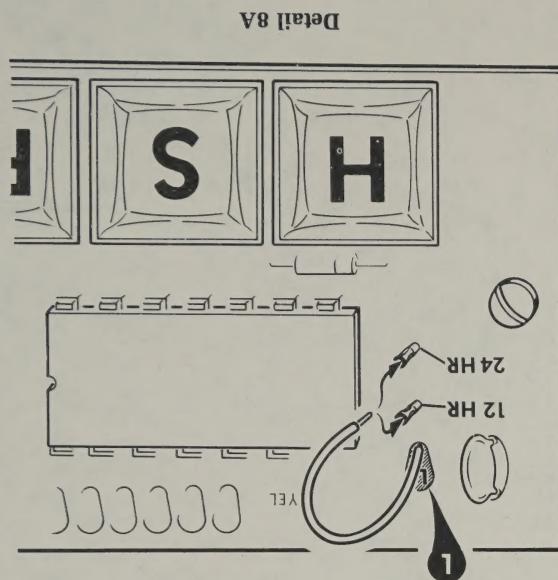
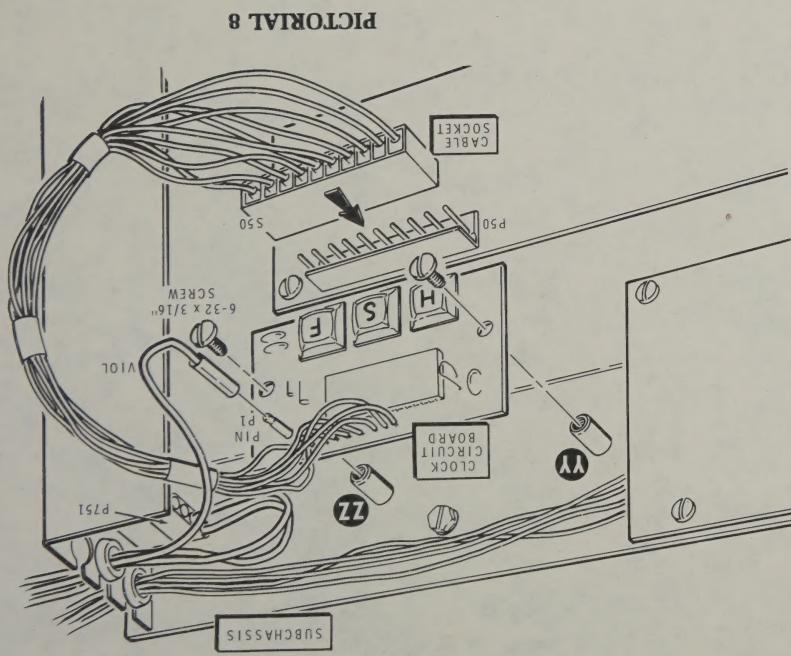
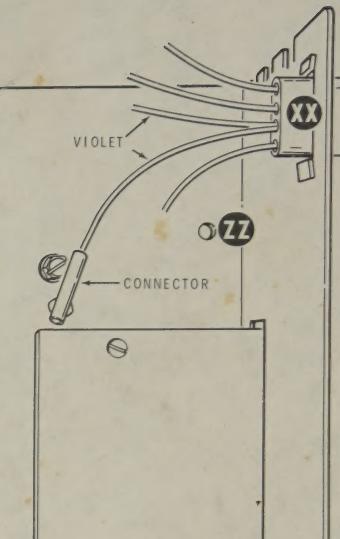
Printed in the United States of America

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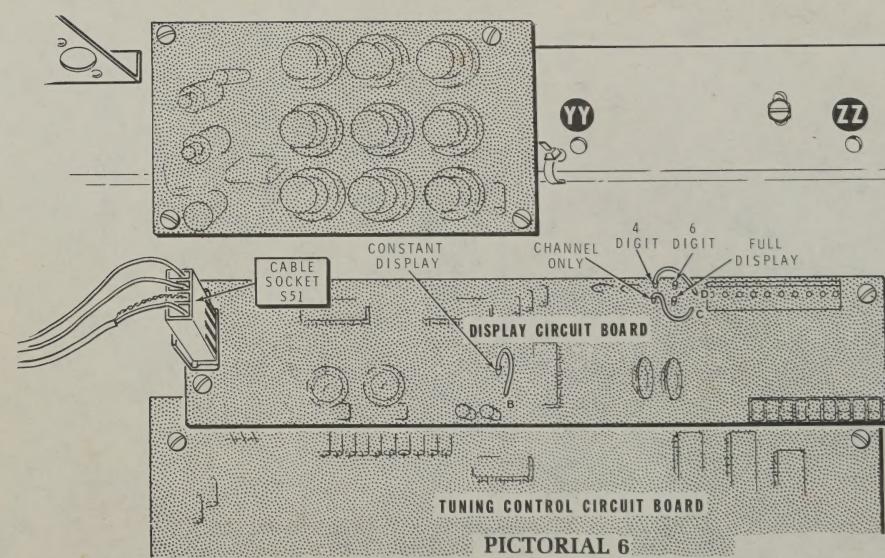
HEATH

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THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

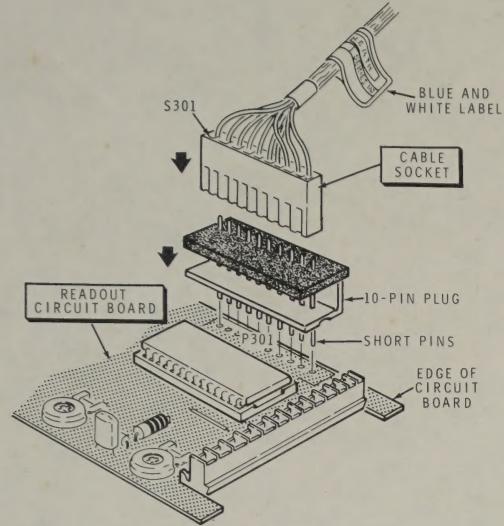
**PICTORIAL 9****ILLUSTRATION BOOKLET**

Part of 595-1913

**PICTORIAL 6**

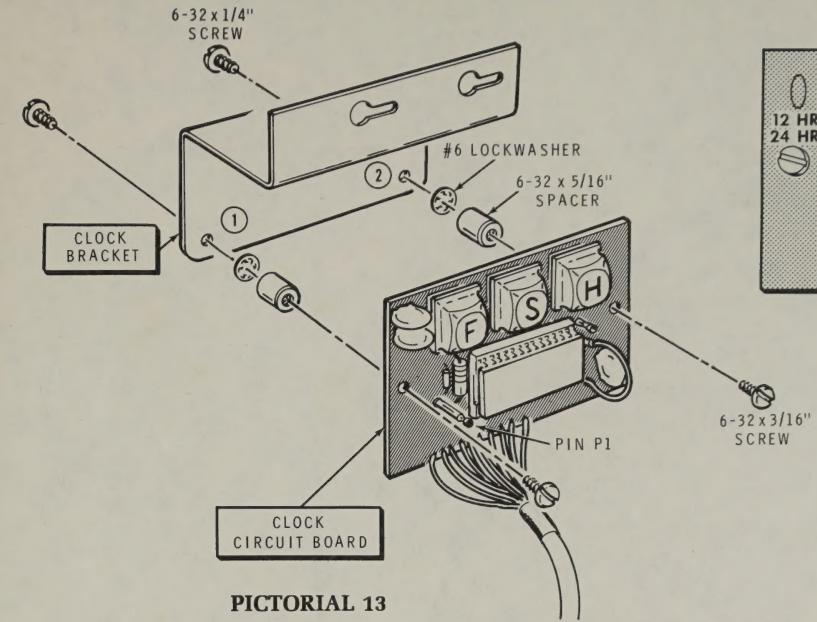
Model GRA-601

Printed in the United States of America



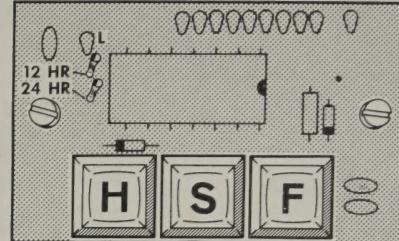
PICTORIAL 10

Page 5

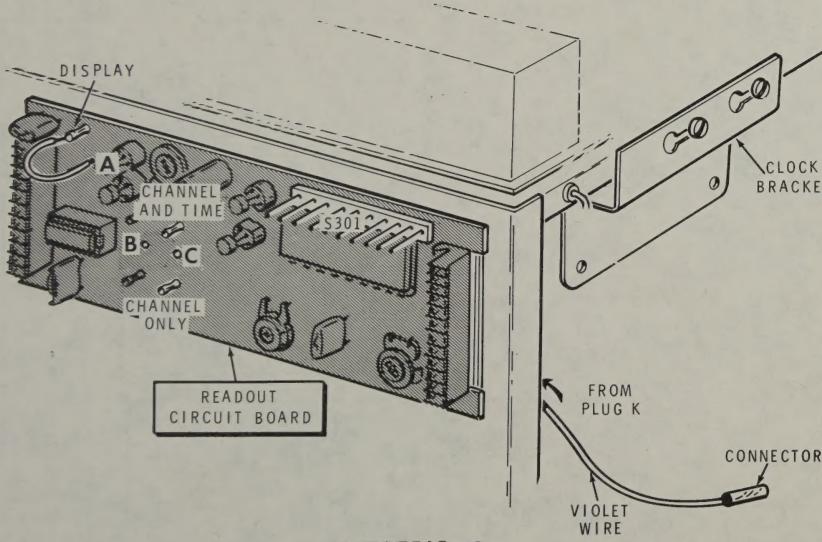


PICTORIAL 13

Page 7



PICTORIAL 14



PICTORIAL 12

Page 6

